

Claims

1. A method for instrumenting virtual-machine-executable software, the software including one or more objects, each object being defined by a class, each class being associated with a class-hierarchy location, the method comprising the steps of:

(a) identifying at least one target class included within the software, the at least one target class being associated with a first class-hierarchy location and with a first class name;

(b) for each target class, adding instrumentation to the software according to at least one of the following steps:

(i) creating a new class, adding instrumentation to the new class, and assigning the new class to a class-hierarchy location adjacent to and above the first class-hierarchy location of the target class; and

(ii) creating a new class, adding instrumentation to the new class, and assigning the new class to a class-hierarchy location adjacent to and below the first class-hierarchy location of the target class, assigning the first class name to the new class and assigning a second class name to the target class; and

(iii) adding instrumentation to the target class without modifying bytecode within the target class;

(c) causing a virtual machine to process as the target class the class assigned the first class name.

2. The method of claim 1 including the following by the steps of :

(aa) after completing step (a), operating a virtual machine to initiate loading and execution of the virtual machine executable software;

(ab) after completing step (aa) suspending the operation of the virtual machine after loading and before linking the at least one target class;

(ca) after completing step (c), un-suspending operation of the virtual machine.

3. The method of claim 1 including the following by the steps of :

(aa) after completing step (a), operating a virtual machine to initiate loading and execution of the virtual machine executable software;

4 (ab) after completing step (aa) interrupting the operation of the virtual machine after
5 loading and before linking the at least one target class to execute a software program that
6 executes step (c);

7 (ca) upon termination of the software program that executes step (c) resuming the
8 operation of the virtual machine.
9

1 4. The method of claim 1 wherein the virtual-machine is a Java virtual machine and the step
2 of identifying at least one target class included within the virtual machine executable software
3 includes the steps of:

4 (a) specifying a set of class attribute names and associated value descriptions matching
5 class attribute names and associated values possessed by at least one class included in the virtual-
6 machine-executable software, the set including one or more of the following attribute names:

- 7 (i) a class name
8 (ii) an interface name
9 (iii) a parent class name
10 (iv) an inherited method name
11 (v) a defined method name
12 (vi) a private method name
13 (vii) an inherited field name
14 (viii) a defined field name
15 (ix) a private field name
16 (x) constant value attribute
17 (xi) synthetic attribute
18 (xii) code attribute
19 (xiii) exception attribute
20 (xiv) depreciated attribute

21 (b) searching for at least one class possessing class attribute names and associated values
22 consistent with the specified class attribute names and associated value descriptions; and

23 (c) classifying the at least one class as a target class.
24

(iii) adding instrumentation to the target class without modifying bytecode within the target class;

(c) a virtual machine for processing as the target class the class assigned the first class name.

/ 14. An apparatus for identifying at least one class included within virtual-machine-executable software, the apparatus comprising:

a class query engine which receives as input a set of class attribute names and associated value descriptions; and

a class searcher that sequentially searches classes included in software and performs a predetermined action upon identifying a class that possesses a set of class attribute names and associated values that match the set of class attribute names and associated value descriptions.

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